chemistry

WATER POLLUTION

Lasers versus effluents

Scientists at Oregon State University led by Dr. D. A. Klein are hoping the laser will solve a water pollution problem. By combining high-energy light as produced by lasers with microbial action, they have been able to destroy wood waste materials from pulp mills or biochemically convert the materials to livestock feed.

The combination attacks the lignin in the wood wastes. Lignin, the cement-like material between plant cells, gives wood its structural stability. The light beam breaks down the lignin molecules, which are resistant to microbes, into simpler compounds that microbes can convert into single cell proteins for animal feed or into easily biodegradable materials.

GEOCHEMISTRY

Mercury marks the spot

Mercury vapor escaping from beneath the earth's surface can indicate the presence of valuable mineral deposits, reports J. H. McCarthy of the U.S. Geological Survey in Denver, Colo.

Most metallic ore deposits, the geochemist explains, contain mercury, the atoms of which, in the form of an extremely weak vapor, can be collected and measured after they leak out of the ground.

The mercury can be detected in the soil gas both at the surface and as high as 200 feet up or more, by a modified atomic absorption spectrophotometer which identifies trace elements by their energy spectrum.

POLYMERS

Lubricant for water

Polyethylene oxide is a polymer whose molecules, arranged in long chains, enable it to reduce the friction between fluids and another surface. This lubricating property has been utilized to get oil out of wells, pump water quickly into fire hoses and speed wastes along sewer pipes.

One area of great potential is ships. Recent tests in England have shown that by spewing a mixture of water and polyethylene oxide through slots near the bow and letting it wash back, a ship's speed can be increased and its fuel consumption reduced.

RADIATION

Plastics from pollutants

Scientists at the Atomic Energy Commission's Brookhaven National Laboratory in Upton, N.Y., have found a way to put two of the worst air pollutants—sulfur dioxide and carbon monoxide—to practical use. They combine them separately with ethylene—a simple gaseous hydrocarbon—in high-pressure vessels and irradiate the mixtures with gamma rays from cobalt 60. Two different plastic materials result.

In the case of ethylene and sulfur dioxide, the compound produced is a polysulfone, a heat-moldable, resistant material desirable for electrical circuits. The assembling of ethylene-carbon monoxide molecules by radiation into a chain-link arrangement called a polymer is not new, but the wide range of conditions used by the Brookhaven researchers has led to many excellent possibilities for end products or as intermediates to make other products.

DESALINATION

New membrane for reverse osmosis

The Department of the Interior's Office of Saline Water has announced the development of a new, highly selective membrane for desalting both seawater and brackish water.

Made of cellulose acetate butyrate, the membrane is designed for use in reverse osmosis. The new material is more effective than simple cellulose acetate, the principal material considered up to now.

Tests on the membrane have shown a consistent salt rejection of as high as 99.8 percent.

A year ago the Office of Saline Water had high hopes for graphitic oxide to supersede cellulose acetate (SN: 3/23/68, p. 286), but it doesn't have the new material's ease of fabrication and transport properties and would be more expensive to produce.

METALLURGY

Ultrapure aluminum

The highest purity aluminum in the United States and possibly the world has been produced by National Bureau of Standards scientists and private industry. The ultrapure aluminum process was worked out by NBS metallurgists of the Cryogenics Division, Boulder, Colo. The actual purification was performed at Cominco in Spokane, Wash.

To obtain the aluminum, whose impurity content is probably less than 0.2 parts per million, two techniques were used. First the aluminum was refined in Europe by a hazardous process involving electrolytic reduction of aluminum triethylene, a very explosive material. Then it was further purified in the United States by zone refining.

REFRIGERANTS

Fast food freezing

A new food-freezing process, demonstrated by E. I. du Pont de Nemours and Company, Inc., uses a special, high-purity Freon, a liquid fluorocarbon commonly used as a refrigerant. When sprayed on food or when food is immersed in it, the Freon freezes the food instantly by vaporization. The vapor is then condensed to a liquid and reused.

The coolant can freeze single particles of food such as individual stringbeans, strawberries and peas. Freon, which vaporizes at minus 22 degrees F. cuts food-freezing costs three to five times, says Du Pont.

Liquid nitrogen, which boils at minus 320 degrees F., is commonly used as a food freezer. Although much colder, it doesn't act as fast because the Freon vaporizes, taking off heat rapidly in the process.